is not a substitute for adequate volume replacement in a trauma patient. Clearly, until more prospective evaluation of this device is undertaken, its use will continue to arouse controversy.

B. ZANE HOROWITZ, MD
Sacramento, California

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Treatment of Near Drowning

MORE THAN 80,000 near-drowning episodes occur per year, and drowning remains the third leading cause of accidental death in the United States, claiming approximately 9,000 lives a year. Although the basic pathophysiology of near drownings is well established, the treatment of severe cases has been somewhat controversial. Recent studies help provide some answers.

The major physiologic consequences of near drowning are hypoxia, pulmonary edema, and respiratory and metabolic acidosis. Although there are mechanistic differences between seawater and freshwater, the aspiration of substantial quantities of either results in a noncardiogenic pulmonary edema with respiratory compromise. Although changes can occur in serum electrolyte levels, hematocrit, and intravascular volume, these are rarely of clinical significance.

All drowning victims should undergo an attempt at resuscitation. The primary goal of that initial resuscitation should be the immediate initiation of effective respiratory support, possibly before actual extrication from the water. Attempts to drain water from the breathing passages are generally not advisable and may increase the risk of vomiting and aspiration. Therefore, the Heimlich maneuver should not be routinely used, being reserved for those situations in which persistent airway obstruction from foreign matter is suspected or all other attempts at artificial ventilation have failed.

All near-drowning victims should be subsequently evaluated at a hospital regardless of the stability of their symptoms at the scene, although the incidence of delayed or "secondary drowning" after an asymptomatic interval appears to have been exaggerated. All patients who subsequently required admission after saltwater submersion had signs of respiratory distress within the initial four hours. Whether this is also the case for freshwater submersion remains to be established. For those patients who have considerable respiratory distress, there should be a low threshold for early endotracheal intubation and the application of positive pressure ventilation. Temperature should be checked (by the rectum) to detect major hypothermia. Complete neurologic recoveries have been achieved after more than 40 minutes of submersion in cold water in patients as old as 11 years. Therefore, resuscitation efforts in a patient with hypothermia, despite prolonged submersion, should be extremely aggressive, including a consideration of immediate cardiopulmonary bypass.

For normothermic drowning victims, the prognosis is excellent for those patients who are seen with hemodynamic stability and neurologic responsiveness. Patients requiring cardiopulmonary resuscitation and who are initially neurologically unresponsive (Glascow Coma Scale of 3 or 4) carry a poor prognosis. These patients require aggressive supportive intensive care with attention toward optimizing cardiac and pulmonary function. In addition, a number of controversial therapeutic interventions have previously been advocated in these patients. Many of these therapies, such as giving high doses of steroids, have recently been shown to have no effectiveness. While high-dose pentobarbital therapy may help to control intracranial pressure, it does not increase the number of survivors after near drowning. Although there is no doubt that patients who become hypothermic during a near-drowning episode have a better chance of surviving neurologically intact, there is no evidence that the therapeutic use of induced hypothermia increases the quantity or quality of survival. The routine use of intracranial pressure monitoring in these patients is also being questioned but will require further study. The intensive care of these patients should focus on measures to prevent further aggravation of the original cerebral injury. The key to success in the treatment of near-drowning victims is providing aggressive and effective respiratory support at the earliest opportunity.

EDWARD A. PANACEK, MD
Cleveland

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Hypertonic Solutions in Resuscitating Patients in Hemorrhagic Shock

TRAUMA REMAINS a major cause of morbidity and mortality; it is the leading cause of death in persons younger than 35 and the third leading cause of death in all age groups. It is estimated that half of all trauma deaths occur before reaching a hospital, many from lethal injuries that can be dealt with only by trauma prevention. Acute hemorrhage from reparable injuries is also a major cause of morbidity and mortality either owing to inadequate replenishment of the intravascular volume or from late effects of acute hypovolemia such as multiple organ-system failure.

With the introduction of trauma system planning, much has been learned regarding the initial treatment of trauma patients in both the prehospital and hospital phases. It is generally agreed that prehospital personnel contribute to patient survival by protecting the airway and the cervical spine and rapidly transporting patients to a trauma facility. Also agreed is that crystalloids—0.9% normal saline solution, lactated Ringer's mixture—are of little clinical benefit because frequently only small volumes can be infused during transport.

A growing body of evidence and experience indicates that infusing a small volume (4 to 5 ml per kg body weight) of a hypertonic saline solution (2,400 mOsm per liter) temporarily restores systemic hemodynamics as shown by increased blood pressure, cardiac output, and superior mesenteric artery flow. This effect is significantly prolonged when